An Instrument for Detecting Protein Expression Under Radiation and Microgravity, Phase I

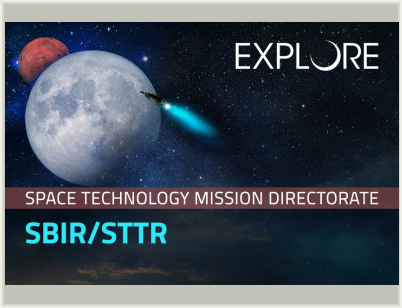
Completed Technology Project (2005 - 2005)

Project Introduction

An understanding of the basic cellular mechanisms organisms use to cope with extreme environments is important as we search for life in other parts of the universe and seek to adapt terrestrial life beyond earth. Radiation Monitoring Devices, Inc. proposes to build an automated, high-throughput instrument to measure changes in protein expression levels in single living cells during passage in a space environment. Commercial libraries of clones expressing GFP (green fluorescent proteins) fused to individual yeast proteins are available for the entire yeast proteome. We will test the feasibility of using fluorescence measurements of these chimeric fusion proteins as an indicator of changes in the expression levels of the endogenous proteins upon exposure to radiation. Our instrument consists of a continuous, multi-well, suspension culture bioreactor that provides yeast clones that are sampled in a microfluidic flow cytometer. Light scattering and fluorescent signals from the yeast particles under flow will activate an in-line cell sorter to collect cells of interest for follow-up analysis. Since the instrument is self-contained, has low power consumption and a small footprint, and uses fluidic based cell separation, it will be suitable for collecting single cell protein expression information in a space laboratory.

Anticipated Benefits

Many commercial applications arise for this instrument which combines a continuous cell culture bioreactor and a microfluidic flow cytometer/ cell sorter, including drug testing, combinatorial analysis, and stem cell differentiation. The bioreactor component fills an unmet need for culturing multiple clones or different cell lines under identical growth conditions in limited volumes. The cytometric analyzer/sorter provides an economical alternative to large-frame, general purpose, cell sorters in markets where high-throughput, dedicated purpose, cell screening is required. Multiple wavelength fluorescence measurements may be easily accommodated by using Geiger-mode APD arrays rather than single element APDs.



An Instrument for Detecting Protein Expression Under Radiation and Microgravity, Phase I

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Organizational Responsibility	1
Primary U.S. Work Locations and Key Partners	2
Project Management	2
Technology Areas	2

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Ames Research Center (ARC)

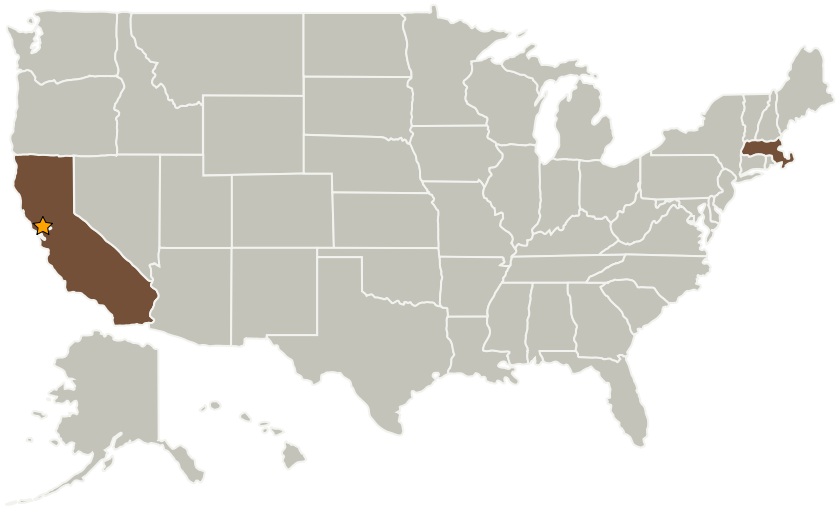
Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

An Instrument for Detecting Protein Expression Under Radiation and Microgravity, Phase I

Completed Technology Project (2005 - 2005)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Ames Research Center(ARC)	Lead Organization	NASA Center	Moffett Field, California
Radiation Monitoring Devices, Inc.	Supporting Organization	Industry	Watertown, Massachusetts

Primary U.S. Work Locations	
California	Massachusetts

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Project Manager:
Tore Straume

Principal Investigator:
Louis Strong

Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.2 Mobility
    - TX04.2.2 Above-Surface Mobility